GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION

LOK SABHA
UNSTARRED QUESTION NO. 5859
TO BE ANSWERED ON 03/04/2018

EMISSION OF GREENHOUSE IN AGRICULTURE SECTOR

5859. SHRI RAJIV PRATAP RUDY:

Will the Minister of AGRICULTURE AND FARMERS WELFARE कृषि और किसान कल्याण मंत्री be pleased to state:

(a) whether the agriculture sector is currently responsible for nearly 17 per cent of global anthropogenic greenhouses gas emissions;

(b) if so, the details thereof and the reaction of the Government thereto;

(c) whether the Government has made any assessment regarding impact of climatic change on small agricultural system in the country, if so, the details thereof; and

(d) whether the Government has taken any initiative for climate smart agriculture to reduce the impact of global climate change on the agriculture sector in the country and if so, the details thereof?

A N S W E R

MINISTER OF STATE IN THE MINISTRY OF AGRICULTURE AND FARMERS WELFARE
कृषि और किसान कल्याण मंत्रालय में राज्य मंत्री
(SHRI GAJENDRA SINGH SHEKHAWAT)

(a) Yes, Madam.

(b) India is a Party to the United Nations Framework Convention on Climate Change (UNFCCC).

According to the first Biennial Update Report (BUR), India's gross emissions of Greenhouse Gases were equivalent to 2.136 billion tonnes of CO_2 in 2010. Out of this, Energy sector contributed 71%, Industrial Process and Product Use (IPPU) 8%, Agriculture 18% and Waste sector 3%. About 12% of emissions were offset by carbon sink action of forests and croplands. Therefore, the national GHG net emissions amounted to a total equivalent of 1.884 billion tonnes Gg of CO_2. The sector wise emissions within agriculture in India during the year 2010 are given in **Annexure-I.**

(c) Though the GHG emissions from agriculture sector is much less when compared to other sectors but the overall impact of climate change on agriculture is much more as more than half of the population is dependent on this sector. Agriculture is dependent on many climatic factors like temperature, rainfall, humidity, sunshine duration etc., which are not only impacting the crop performance now; but will in future too. Climatic variations may impact crops both positively and negatively depending on the nature of crop. However, various national and global studies have shown declining trends in crop production of different crops due to climate change.

Details on Indian studies on projected impacts on agriculture (crops, livestock and fish) are given in Annexure-II.

(d) India has made a number of efforts to address climate change. The Government has launched the National Action Plan on Climate Change (NAPCC) in June 2008 to achieve its goals and deal with the issues related to climate change. Thirty-two States and Union Territories (UTs) have also prepared State Action Plan on Climate Change (SAPCC) consistent with the objectives of NAPCC.

As a result of domestic efforts, India's emission intensity of GDP has decreased by 12% between 2005 and 2010.

In order to assess the impact of Climate change/variability on agriculture, Government of India through the Indian Council of Agricultural Research (ICAR) launched a flagship network project 'National Initiative on Climate Resilient Agriculture' (NICRA) during XI Plan in 2011, and from XII Plan it is referred as 'National Innovations in Climate Resilient Agriculture'. This programme is being implemented under four components, viz., Strategic Research (41 ICAR Institutes), Sponsored and Competitive Grants (18 + 33 Projects), Technology Demonstration (121 KVKs, 25 AICRIPAM, 23 AICRIPDA Centers), Capacity Building and Knowledge Management.

The Technology Demonstration Component (TDC) of the National Initiative (Innovations) on Climate Resilient Agriculture was initiated in 2011 to demonstrate the location specific technologies enabling farmers to cope with current climatic variability and to enhance their adaptive capacity. The programme is being taken up in 151 climatically vulnerable districts/KVKs of the country by taking one or two representative villages from each of the district.

****

Annexure-I

[Part (b) of Lok Sabha USQ No.5859 for 03/04/2018]

The sector wise emissions within agriculture in India during the year 2010 are as follows:

Source of emissions	**Quantity (in Gigagrams) CO_2 equivalents**
Enteric fermentation	227,033
Manure management	2,768
Rice cultivation	71,367
Agricultural crop residue	7,915
Emissions from soil	81,080
Emissions from Agricultural sector	**390,165 (18.3% of total emissions of the country)**
Total emissions	**1,884,309 (100%)**

Source: First Biennial Update Report (2015)

****

Annexure-II

[Part (c) of Lok Sabha USQ No.5859 for 03/04/2018]

Indian studies on projected impacts on agriculture (crops, livestock and fish)

Climate change impact projections are worked out for major crops such as rice, wheat, maize, sorghum, mustard, soybean, potato, cotton and coconut. Summary of the projections for these crops as follows:-

- Climate change is projected to reduce irrigated rice yield by ~4 % in 2020 (2010–2039) and rainfed rice yield by 6%. Rainfed rice yields in India to reduce by ~6% in the 2020 and <2.5 % in 2050 (2041-2070) and 2080 (2070-2099) scenarios. With adaptation, however, irrigated rice yield to increase by about 17% and rainfed rice yield by about 20% (Naresh Kumar et al., 2013). Recent study also indicated a reduction in rice yield indifferent agro-climatic regions in India (Singh et al., 2017). Earlier studies also have reported negative impact of climate change in rice yield in some parts of India (Lal et al., 1998; Saseendran et al., 2000, Kumar et al., 2016).
- Wheat yield in India would reduce by 6 to 23% by 2050 scenario, if no adaptation is followed. Yield would reduce in areas with mean seasonal maximum and minimum temperatures more than 27 and 13°C, respectively. Adjusting the time of sowing, suitable variety and input (fertilizer and irrigation) management may be a practical low-cost adaptation strategy to increase the yield (by >10%) in future climates (Naresh Kumar et al., 2014). With every 1^{o}C increase in temperature, wheat yield is projected to lose 6Mt, similarly rice yield is projected to be affected (Aggarwal and Mall 2002, Mall and Aggarwal, 2002, Aggarwal and Swaroopa Rani, 2009).
- Maize yield in kharif season is projected to decrease by 18% but adaptation can increase the yield up to 21% in 2020 scenario (Byjesh et al., 2010; Naresh Kumar et al., 2012).Earlier studies suggest a 2 to 5% decrease in yield potential of wheat and maize for a temperature rise of 0.5 to 1.5°C in India (Aggarwal, 2003).
- Rainfed sorghum yield is projected to reduce by 2.5% in 2020 (2010-2039). Adaptation, however, can increase the productivity by 8% in 2020 (Srivastava et al., 2010; Naresh Kumar et al., 2012).
- Mustard yield is projected to reduce by ~2% in 2020 (2010–2039). Regions with mean seasonal temperature regimes above 25/10 °C to lose due to temperature rise. As climatically suitable period for mustard cultivation may reduce in future, short-duration (<130 days) cultivars with 63% pod filling period will become more adaptable (Naresh Kumar et al., 2015).
- Increase in soybean yield in the range of 8-13% under different future climate scenarios (2030 and 2080) is projected. In case of rainfed groundnut, except in the climate scenario of A1B 2080 (-5%), in rest of the scenarios yield is projected to increase by 4-7% (Bhatia et al., 2012; Naresh Kumar et al., 2012).
- The potato crop duration in the Indo-Gangetic Plains is projected to decrease and yield is to reduce by ~2.5, ~6 and ~11% in 2020 (2010-2039), 2050 (2040-2069) and 2080 time periods, respectively. Change in planting time could be the most important adaptation option which may lead to yield gain by ~6% in 2020 (Naresh Kumar et al., 2016).
- Cotton productivity in northern India may marginally decline due to climate change while in central and southern India, productivity may increase. However, at the national level, cotton productivity is may not be affected (Hebbar et al., 2013).
- Climate change is projected to increase coconut productivity in western coastal region, Kerala, parts of Tamil Nadu, Karnataka and Maharashtra (provided current level of water and management is made available in future climates as well) and also in North-Eastern states, islands of Andaman and Nicobar and Lakshadweep while negative impacts are

projected for Andhra Pradesh, Orissa, West Bengal, Gujarat and parts of Karnataka and Tamil Nadu. Productivity in India can be improved by 20% to almost double if all plantations in India are provided with location specific agronomic and genotype intervention in current climates (Naresh Kumar and Aggarwal, 2014).

- Apple productivity is affected and its cultivation is shifted to higher latitudes to 2500 mamsl from 1250 mamsl in Himachal Pradesh (Bhagat et al., 2009).
- Climatic stresses such as heavy rainfall events damage horticultural crops. Flooding for 24 h affects tomato with flowering period being sensitive. Similarly, onion bulb initiation stage is sensitive to flooding causing a 27 and 48% reduction in bulb size and yield, respectively (Rao et al., 2009).
- Climate change is projected to affect the quality in terms of reduced concentration of grain protein (under low fertilizer input conditions), and some minerals like zinc and iron due to elevated CO_2 (Porter et al., 2014).
- Elevated CO_2 caused reduction in the concentration of protein, secondary metabolites while rise in temperature enhanced their concentration in pulse, several vegetable and fruit crops.
- Global warming is likely to lead to a loss of 1.6 Mt milk production by 2020 and 15 Mt by 2050 if no adaptation is followed. The losses may be highest in UP followed by Tamil Nadu, Rajasthan and West Bengal. Increased number of heat stress days and probable decline in availability of water may further impact animal productivity (Upadhyay et al., 2013).
- Rise in temperature caused latitudinal extension in abundance of oil sardine along the Indian cost. Marine fish availability has extended to deep waters and the spawning activity of *Nemipterus* spp. reduced in summer months and shifted towards cooler months (Vivekanandan et al., 2013).
- Breeding season of Indian major carps extended from 110-120 days (Pre 1980-85) to 160-170 days, making it possible to breed them twice in a year at an interval ranging from 30-60 days (Das et al., 2013).
- Rise in temperature causes reduction in egg and meat production of poultry birds. The critical body temperature at which the poultry birds succumb to death is 45 °C which was observed at the shed temperature of 42 °C (Reddy et al., 2013).
- Climate change is projected to increase soil erosion, affect water availability and quality (IPCC, 2014).
- Indian farmers have been adapting to climatic risks. A detailed household level analysis in a village indicated that the cost of adaptation and gains vary with type of climatic risk, type of agriculture and farm size. Strategies such as improved varieties, crop diversification, crop water and livestock management, value additions, etc. have led to farm resilience to climatic risks. Small and marginal farm (<4 acre) families can't support themselves with agricultural income alone; however with adaptation a self-sustaining agriculture could be achieved. Additional cost is not always required for adaptation (particularly in mid and large farm holdings) and rationalizing agricultural expenditure through scientific crop management is essential for adapting to climatic risks (Naresh Kumar et al., 2014; 2016).

******